

Optimizing Design by Understanding How Lab Environment, Type and Application Affect Energy Use

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Many Tools Available for Energy Reduction

† Application of Tools Influenced by:

† What Happens in Lab

† Who's Building the Lab

† Lab Environment

† Heat Gain

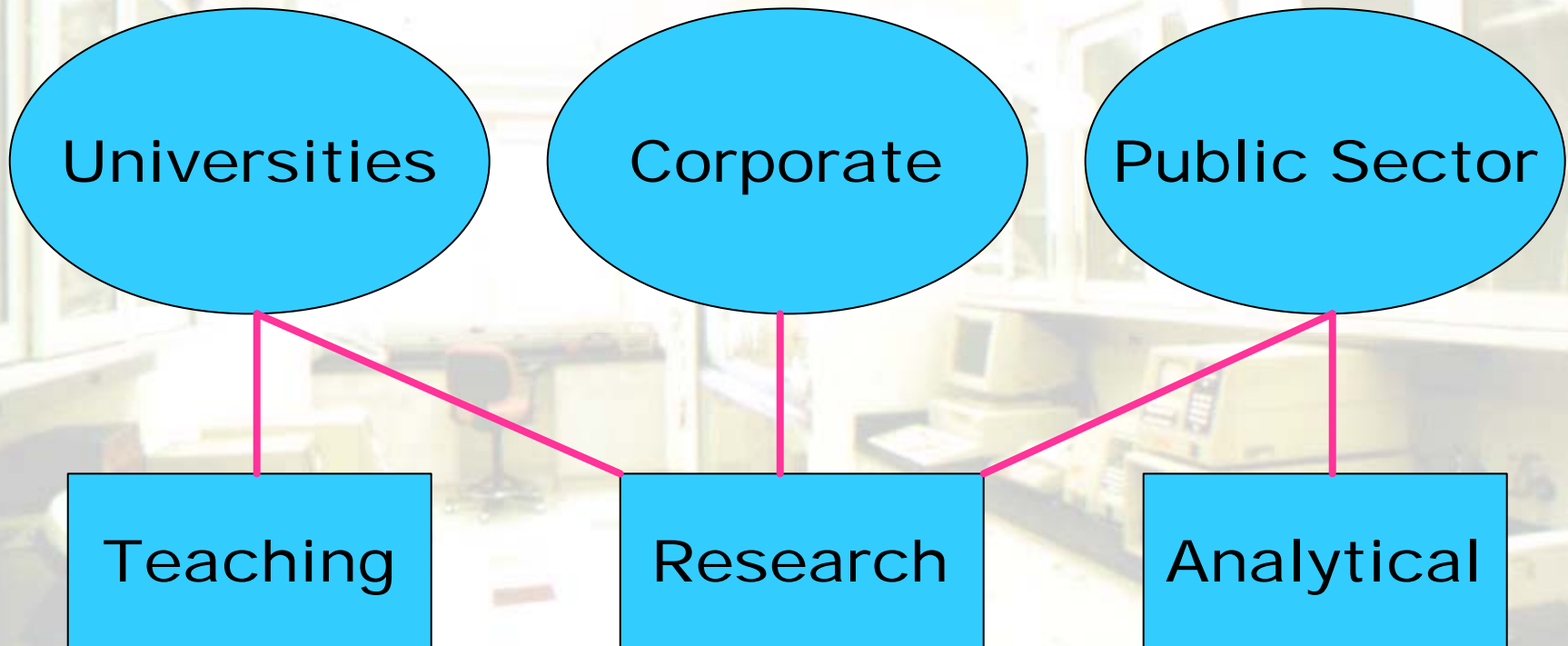
† Fume Hood Density

† Occupancy Profile

† ASHRAE 90.1-1999



Who Builds Labs and Why?



Characteristics of Lab Types

Corporate

Research

- † Time-to-Market
- † High-Throughput Studies
- † Construction Cost v.
- † Revenue for New Products
- † High-Velocity Project Delivery

Design Parameters: Corporate Research



Corporate

Research

- † Airflow: 1.6 - 2.0 cfm/ft²
- † Chilled Water: 95-110 ft²/ton
- † Energy Reduction:
 - † Operating Cost Concern
 - † Construction Budget Constraint

Energy Reduction Opportunities: Corporate Research

† Heat Recovery

- † Central Utility Project Deferral

- † Site Emissions Constraint

† Variable Volume Airflow - Diversity

- † Peak Fume Hood Usage:

- † Historical Data:

 - † **50% of ultimate is common**

 - † **no “morning spike”**

 - † **high rate of compliance**

Energy Reduction Opportunities: Corporate Research

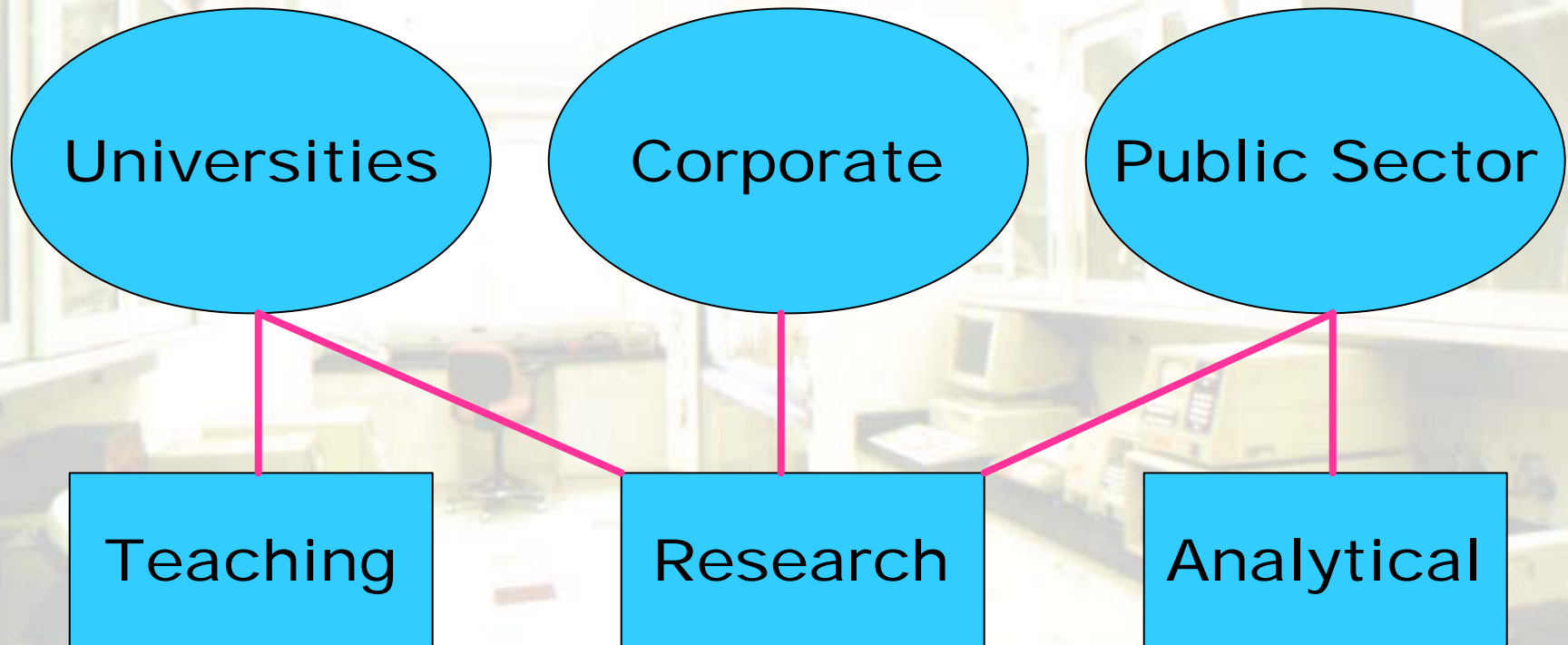
† Track Diversity:

- † Variable Speed Fans
- † Floating Duct Pressure Setpoint

† Equipment Rooms

- † 40 - 50 W/ft² Heat Gain
- † Offset Heat Gain with Chilled Water
- † **Less 100% Outside Air Usage**

Who Builds Labs and Why?



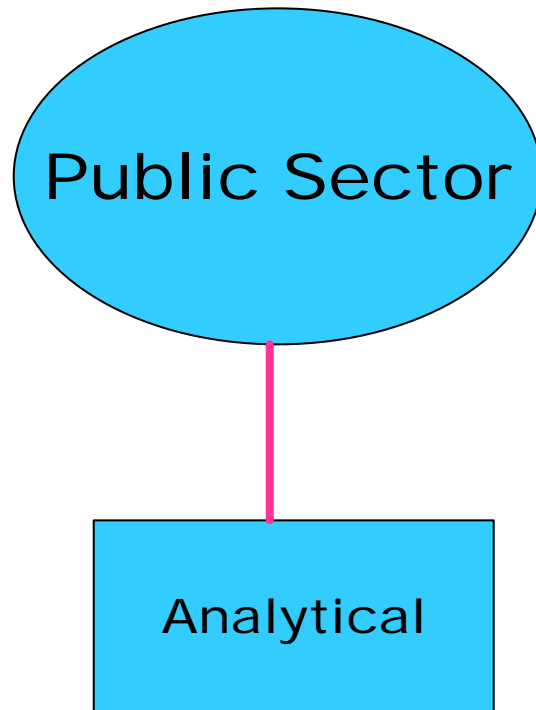
Characteristics of Lab Types

Public Sector

Analytical

- † Longer Project Delivery
- † Low Flexibility
 - † Minimal Program Shifts
- † Forensics Labs
 - † Contamination of Product
 - † More Fan Energy
 - † HEPA Filtration

Design Parameters: Public Sector Analytical Labs



- † Airflow: 2.0 - 2.2 cfm/ft²
- † Chilled Water: 65 - 90 ft²/ton
- † Energy Reduction:
 - † Lifecycle Cost Analysis



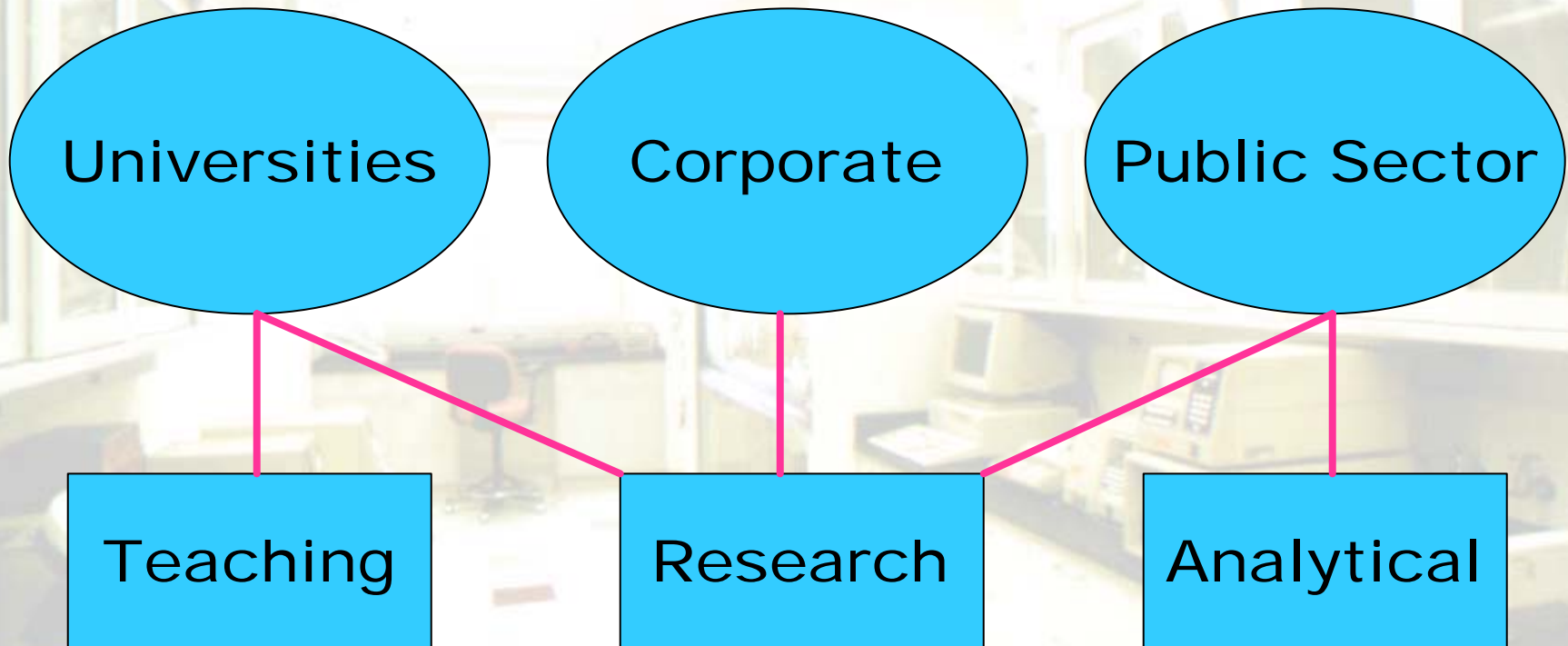
Energy Reduction Opportunities: Public Sector Analytical Labs

Public Sector

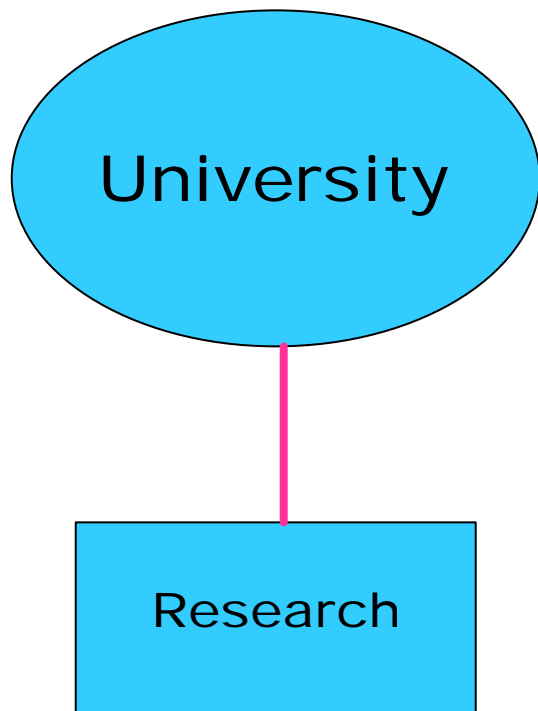
Analytical

- † High Heat Gain (Design)
 - † Actual: Much Less
 - † Variable Volume Airflow
 - † **Tracks Design v. Actual**
- † Return Air - Non-Chem Labs
 - † Flexibility for Conversion

Who Builds Labs and Why?

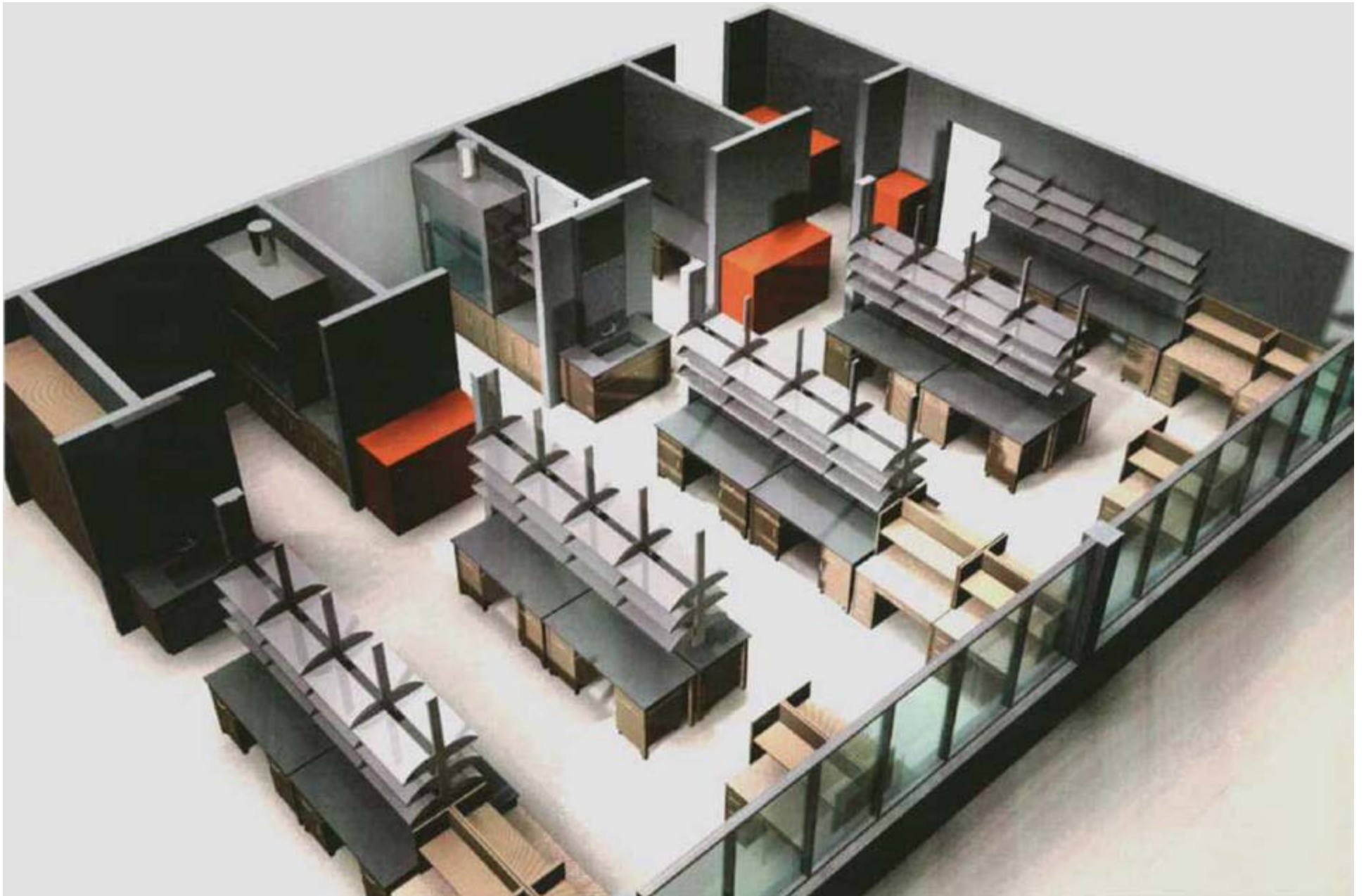


Characteristics of Lab Types



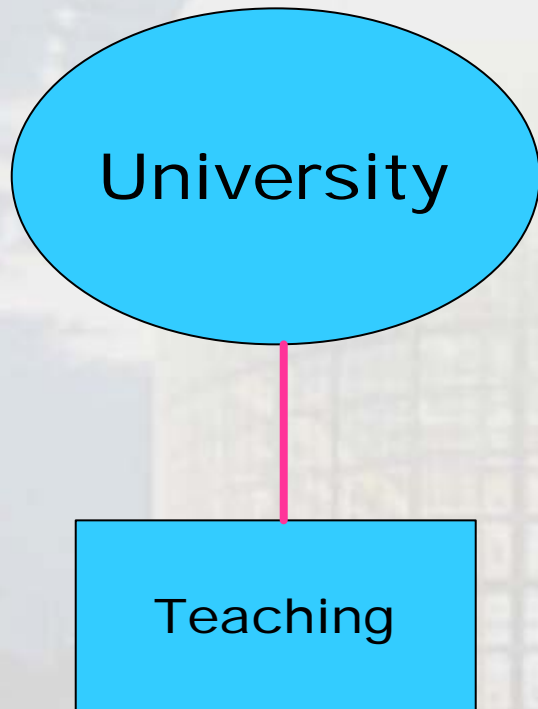
- † Often Grant-Driven
- † Flexibility as Grants Change
- † Nonlinear Funding Stream
- † Conversion to Teach Labs?





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Characteristics of Lab Types



- † High Fume Hood Density
- † Double-Sided - High Airflows
- † Acoustical Issues
- † Intermittent Occupancy:
 - † 2-Position Constant Volume
 - † Heat Recovery Not Likely
- † Maintenance Burden

Design Parameters: University Labs



University

Teaching
and Research

† Airflows:

† Research: 1.3 - 1.6 cfm/ft²

† Teaching: 2.5 - 6.0 cfm/ft²

† Chilled Water (Blended):

† **110 - 150 ft²/ton**

† Low Fume Hood/Heat Gains

Energy Reduction Opportunities: University Labs



University

Teaching
and Research

- † Omit Humidification
 - † Tradeoff - Indoor Air Quality
- † Teaching Labs
 - † Intermittent Occupancy
 - † 2-Position Constant Volume
 - † Justification of Alternatives
- † Research Labs
 - † Maintenance Constraint

Summary

- † Energy Reduction Opportunities Relate to:
 - † Culture of Owner
 - † **Economic Analysis/Hurdle Rate**
 - † **Receptive to Energy Issues**
 - † Occupancy Profile
 - † Lab Program
 - † **Associated Flexibility**
 - † **Density of Utilities**